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I, the below named verifier, hereby certify that:

(1) My name and post office address are as stated below;

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(3) I believe the attached is a full, true and faithful translation into the English language of the

[X] Amendment under PCT Article 19

[X] Explanation in accordance with Article 19(1) of the Convention

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of International Application PCT/ JP03/04925, filed 17 April 2003 under the Patent Cooperation Treaty.

I declare further that all statements made herein on personal knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 26th day of November, 20 04.

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CLAIMS

1. A flexible printed circuit board having a copper thin film made of copper or an alloy containing primarily copper and directly formed on at least one side of a plastic film substrate, wherein

said copper thin film has a two-layer structure comprising a surface layer having at least a crystalline structure on the surface side of said copper thin film and a bottom layer formed between said surface layer and said plastic film substrate, and the X-ray relative intensity ratio between crystal lattice plane indices (200)/(111) in the crystalline structure of said surface layer is 0.1 or less.

2. The flexible printed circuit board in accordance with claim 1, wherein said surface layer having the crystalline structure is composed of crystal grains having at least the crystal lattice plane index (111) and that said crystalline structure is a columnar structure.

3. The flexible printed circuit board in accordance with claim 1, wherein said surface layer having the crystalline structure is composed of columnar crystal grains having at least the crystal lattice plane index

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(111) and that said crystal grains are formed into a cylindrical shape, a polygonal columnar shape or a shape of a mixture of these.

4. The flexible printed circuit board in accordance with claim 1, wherein said surface layer having the crystalline structure is composed of columnar crystal grains having at least the crystal lattice plane index (111) and that said crystal grains are formed into a needle shape on the side of said bottom layer making contact with said plastic film substrate.

5. The flexible printed circuit board in accordance with claim 1, wherein the columnar crystal grains having the crystal lattice plane index (111) and constituting said surface layer having the crystalline structure have a plane of said crystal lattice plane index (111) to be arranged according to preferred orientation in parallel to the surface of said plastic film.

6. The flexible printed circuit board in accordance with claim 1, wherein said copper thin film made of copper or an alloy containing primarily copper on said plastic film substrate is composed of crystal grains having at least the crystal lattice plane index (111) and

that said bottom layer made of a polycrystalline copper thin film is provided between said crystal grains and said plastic film substrate.

7. A flexible printed circuit board comprising a copper thin film made of copper or an alloy containing primarily copper directly formed on at least one side of a plastic film substrate, and copper formed on said copper thin film by the electrolytic plating method, wherein

said copper thin film made of copper or an alloy containing primarily copper on said plastic film substrate is composed of crystal grains having at least the crystal lattice plane index (111) and that the grain size of the short axis of said crystal grains is 20 nm to 100 nm.

8. The flexible printed circuit board in accordance with claim 7, wherein said copper thin film made of copper or an alloy containing primarily copper on said plastic film substrate is composed of crystal grains having at least the crystal lattice plane index (111), and said bottom layer made of a polycrystalline copper thin film is provided between said crystal grains and said plastic film substrate.

9. The flexible printed circuit board in

accordance with claim 6 or claim 8, wherein said copper thin film of said bottom layer made of copper or an alloy containing primarily copper and making contact with said plastic film substrate has a spherical structure.

10. A flexible printed circuit board comprising a copper thin film made of copper or an alloy containing primarily copper directly formed on at least one side of a plastic film substrate, and copper formed on said copper thin film by the electrolytic plating method, wherein

said copper thin film made of copper or an alloy containing primarily copper on said plastic film substrate has at least a two-layer structure, and said copper thin film of said bottom layer making contact with said plastic film substrate has a spherical structure, said copper thin film of said surface layer on said bottom layer has a columnar structure, and the diameter of said spherical structure of said bottom layer is made smaller than the grain size of said columnar structure of said surface layer.

11. A flexible printed circuit board comprising a copper thin film made of copper or an alloy containing primarily copper directly formed on at least one side of a plastic film substrate, and copper formed on said copper

thin film by the electrolytic plating method, wherein

the fluctuation width of the irregular face on the boundary face between said plastic film substrate and said copper thin film made of copper or an alloy containing primarily copper is in the range of 0.5 nm to 10 nm.

12. The flexible printed circuit board in accordance with claim 10 or 11, wherein said copper thin film of said bottom layer made of copper or an alloy containing primarily copper and making contact with said plastic film substrate has polycrystals.

13. The flexible printed circuit board in accordance with claim 9, 10 or 11, wherein said copper thin film of said bottom layer made of copper or an alloy containing primarily copper and making contact with said plastic film substrate has a spherical structure having a diameter of 10 nm to 80 nm.

14. The flexible printed circuit board in accordance with claim 9, 10 or 11, wherein said copper thin film of said bottom layer made of copper or an alloy containing primarily copper and making contact with said plastic film substrate has a film thickness of 10 nm to

100 nm.

15. The flexible printed circuit board in accordance with claim 1, 7, 10 or 11, wherein said copper thin film made of copper or an alloy containing primarily copper on said plastic film substrate has a film thickness of 100 nm to 500 nm.

16. The flexible printed circuit board in accordance with claim 10, wherein said copper thin film of said surface layer is composed of crystal grains having the crystal lattice plane index (111).

17. The flexible printed circuit board in accordance with claim 10, wherein the grain size of the short axis of the crystal grains having the crystal lattice plane index (111) and constituting said surface layer is 20 nm to 100 nm.

18. The flexible printed circuit board in accordance with claim 10, wherein said copper thin film of said surface layer has a columnar structure being formed into a needle shape on the side of said bottom layer making contact with said plastic film substrate.

19. The flexible printed circuit board in accordance with claim 18, wherein said copper thin film of said surface layer is formed into a cylindrical shape, a polygonal columnar shape or a shape of a mixture of these.

20. The flexible printed circuit board in accordance with claim 1, 7, 10 or 11, wherein said plastic film substrate is made of at least one material selected from among polyimide film, Teflon (registered trademark) and liquid crystal polymer.

21. A method for producing a flexible printed circuit board comprising:

a step of subjecting a plastic film substrate to dewatering processing in vacuum,

a step of introducing a mixture gas containing nitrogen in vacuum,

a step of melting copper or a metal of an alloy containing primarily copper,

a step of generating glow discharge by applying high-frequency power to said plastic film substrate by using stable discharging means, and

an evaporation step of evaporating said metal to said plastic film substrate by ionizing said mixture gas and metal and by accelerating said ions by using a

negative bias voltage induced by the glow discharge, wherein

at least nitrogen and argon are introduced at said evaporation step.

22. A method for producing a flexible printed circuit board comprising:

a step of subjecting a plastic film substrate to dewatering processing in vacuum,

a step of introducing a mixture gas containing at least nitrogen, generating glow discharge by applying high-frequency power to said plastic film substrate by using stable discharging means and ionizing said mixture gas,

a step of subjecting said plastic film substrate to plasma processing by using the gas containing nitrogen ionized by the negative bias voltage induced in said plastic film substrate,

a step of subsequently melting a metal of copper or an alloy containing primarily copper in vacuum, generating glow discharge by using a mixture gas containing argon and by applying high-frequency power to said plastic film substrate by using stable discharging means and ionizing said mixture gas and said metal of copper or an alloy containing primarily copper, and

a step of evaporating a copper thin film onto said plastic film substrate by accelerating said ionized grains by using a negative bias voltage induced in said plastic film substrate.

23. The method for producing a flexible printed circuit board in accordance with claim 21 or 22, wherein the step of subjecting said plastic film substrate to dewatering processing in vacuum includes a step of carrying out dewatering processing so that the partial pressure of moisture is 10^{-3} Pa or less.

24. The method for producing a flexible printed circuit board in accordance with claim 22, wherein at the step of carrying out the plasma processing by using said mixture gas containing at least nitrogen, the pressure is in the range of 10^{-3} Pa to 10^{-1} Pa, and said negative bias voltage induced in said plastic film substrate is 200 V to 1000 V.

25. The method for producing a flexible printed circuit board in accordance with claim 22 or 24, wherein at the step of carrying out the plasma processing by using said mixture gas containing at least nitrogen, said mixture gas contains nitrogen and an inert gas, the

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volumetric ratio of nitrogen in the entire gas being set at approximately 50% to approximately 100%.

26. The method for producing a flexible printed circuit board in accordance with claim 21, wherein at the step of evaporating said copper thin film on said plastic film substrate, said mixture gas containing nitrogen is a mixture gas containing nitrogen and an inert gas, the volumetric ratio of nitrogen in the entire gas being set at approximately 1% to approximately 20%.

27. The method for producing a flexible printed circuit board in accordance with claim 21 or 22, wherein at the step of evaporating said copper thin film on said plastic film substrate, the pressure is in the range of 10^{-3} Pa to 10^{-1} Pa, and said negative bias voltage induced in said plastic film substrate is 200 V to 1000 V.

28. The method for producing a flexible printed circuit board in accordance with claim 21 or 22, wherein at the step of evaporating said copper thin film on said plastic film substrate, a copper thin film having a film thickness of 10 nm to 100 nm is formed at an evaporation speed of 0.1 nm/sec to 0.5 nm/sec in the early stage of the evaporation, and film-forming is carried out

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subsequently at an evaporation speed of 0.5 nm/sec to 10 nm/sec so that the total film thickness of said copper thin film is 100 nm to 500 nm.